

**CONTROL SIGNALING FOR UPLINK
MULTIPLE INPUT MULTIPLE OUTPUT,
CHANNEL STATE INFORMATION
REFERENCE SIGNAL CONFIGURATION
AND SOUNDING REFERENCE SIGNAL
CONFIGURATION**

RELATED APPLICATIONS

[0001] The present application claims priority under 35 U.S.C. § 119 to U.S. Provisional App. No. 62/620,176 filed Jan. 22, 2018 and U.S. Provisional App. No. 62/651,550 filed Apr. 2, 2018, and claims priority under 35 U.S.C. § 120 to International App. No. PCT/CN2018/076922 filed Feb. 16, 2018. The contents of each of the aforementioned applications are hereby incorporated by reference in their entireties.

FIELD

[0002] Various embodiments of the present application generally relate to the field of wireless communications, and in particular, to channel state information reference signal configurations, sounding reference signal configurations, and control signaling for uplink multiple input multiple output.

BACKGROUND

[0003] In the fifth generation (5G) systems, two different transmission schemes are supported for uplink (UL) transmissions. One transmission scheme is codebook based transmission, and the other transmission schemes is non-codebook based transmission. For codebook based transmission, a user equipment (UE) can be configured with up to one sounding reference signal (SRS) resource set with up to two SRS resources. For non-codebook based transmission, the UE can be configured with up to one SRS resource set with up to four SRS resources. For each SRS resource, the resource mapping pattern including frequency offset, comb and number of symbols, antenna port(s), and time domain behavior (e.g., periodic, aperiodic, or semi-persistent scheduling (SPS) based transmission) can be configured by radio resource control (RRC) signaling. Therefore, different SRS resources can have different configurations.

[0004] Additionally, for uplink codebook based transmission, it is possible that the UE is not configured with any SRS resource. In this case, a Demodulation Reference Signal (DM-RS) can be used for link adaptation. The uplink precoder can be selected based on the DMRS. The number of antenna ports could be the maximum number of layers the UE can support, which can reflect the UE's capability of number of antenna ports. Multi-panel UEs may have multiple DMRS groups and the targeting receiving next generation NodeB (gNB) may be different.

[0005] Furthermore, the channel state information reference signal (CSI-RS) and SRS may be used for CSI estimation and beam management. The CSI-RS may also be used for time and frequency offset tracking. There are three types of CSI-RS including CSI-RS for CSI acquisition, CSI-RS for layer 1 reference signal receiving power (L1-RSRP) computation, and CSI-RS for tracking. Moreover, there are four types of SRS including SRS for codebook based transmission, SRS for non-codebook transmission, SRS for beam management, and SRS for antenna switching. However, the three types of CSI-RS share the same con-

figuration and all the four types of SRS share the same configuration. This may lead to conflicts or redundant signaling for some configurations.

BRIEF DESCRIPTION OF THE FIGURES

[0006] FIG. 1 depicts an architecture of a system of a network in accordance with some embodiments.

[0007] FIG. 2 illustrates an example of media access control (MAC) control element (CE) based sounding reference signal (SRS) reconfiguration according to various embodiments.

[0008] FIG. 3a illustrates an example of SRS time domain behavior on a per resource basis according to a first embodiment.

[0009] FIG. 3b illustrates an example of SRS time domain behavior on a per resource basis according to a second embodiment.

[0010] FIG. 4 illustrates an example SRS triggering mechanism for two types of SRS resource sets according to various embodiments.

[0011] FIG. 5 depicts an architecture of a system including a first core network in accordance with some embodiments.

[0012] FIG. 6 depicts an architecture of a system including a second core network in accordance with some embodiments.

[0013] FIG. 7 depicts an example of infrastructure equipment in accordance with various embodiments.

[0014] FIG. 8 depicts example components of a computer platform in accordance with various embodiments.

[0015] FIG. 9 depicts a block diagram illustrating components, according to some example embodiments, able to read instructions from a machine-readable or computer-readable medium (e.g., a non-transitory machine-readable storage medium) and perform any one or more of the methodologies discussed herein.

[0016] FIG. 10 depicts example components of baseband circuitry and radio frequency circuitry in accordance with various embodiments.

[0017] FIG. 11 is an illustration of various protocol functions that may be used for various protocol stacks in accordance with various embodiments.

[0018] FIGS. 12-14 depict example processes for practicing the various embodiments discussed herein. In particular, FIG. 12 depicts an example UL MIMO procedure according to various embodiments; FIG. 13 shows an example configuration process according to various embodiments; and FIG. 14 depicts an example procedure according to various embodiments.

DETAILED DESCRIPTION

[0019] Embodiments herein provide mechanisms for control signaling of UL multiple input multiple output (MIMO). Such embodiments include SRS resource configuration; control signaling for uplink codebook based transmission when no SRS resource is configured; and control signaling for uplink non-codebook based transmission when no SRS resource is configured. Additionally, embodiments herein provide mechanisms for sounding reference signal (SRS) and channel state information reference signal (CSI-RS) configuration. Such embodiments include restriction of CSI-RS configuration, and restriction of SRS configuration. Other embodiments may be described and/or claimed.